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root action excessive. The remedy would seem to be in providing a cooler, dryer soil with increased light for the aerial parts, whenever possible. BYRON D. HALSTED.

Contributions to American Bryology, III.

BY ELIZABETH G. BRITTON.

NOTES ON THE NORTH AMERICAN SPECIES OF ORTHOTRICHUM.

A. Those with superficial stomata.

ORTHOTRICHUM OBTUSIFOLIUM, Schrad. Crypt. Gew. 14 (1796).

Though, as its name implies, the leaves of this species are generally blunt, yet Austin collected specimens on trees in a swamp, at Jordansville, N. Y., on December 15, 1879, having the "leaves either obtuse, or acute or even apiculate on the same stem." I have verified this statement, and also observed that the perichætial leaves are occasionally even acuminate, as seen on specimens recently collected by me on the Pocono Mountain, Pennsylvania, the specimens being in fruit, and the leaves bearing the propagula and dense papillæ, which are characteristics of this species.

Although it generally grows on trees, especially poplars, and has been collected on elms along highways, and on old apple trees, yet Austin also gathered it on limestone fences, Sussex Co., N. J., and on stone walls, Herkimer Co., N. Y. These specimens are smaller and darker green than usual, for Canadian and Western specimens as well as most European ones are often light yellow with stems 1–2 cm. long. This species is probably more common in the Eastern States than is supposed, but on account of its depauperate size and frequent sterility is seldom collected.

ORTHOTRICHUM STRIATUM (L.) Hedw.

O. leiocarpum, Br. & Sch. Br. Eu. t. 220 (1837).

Sullivant and Lesquereux distributed this species as number 183, Musci Bor. Am., Ed. II., 1865, mixed with *O. affine*, presumably from two localities, as the label reads: Hab. in iisdem cum praecedente (Agassiz); etiam per montes Novaeboracenses. The first locality was Lake Superior, the second locality is not cited in the Manual, and we have seen no specimens except from the one referred to above and those collected in Idaho by J. B. Leiberg; the species seems to be very rare in America. Number 183 agrees with the description given by Limpricht, and with European specimens, and is particularly noticeable for the broad, erose cilia, alternating with and nearly as broad as the teeth and often united by transverse bars.

In Austin's herbarium this species is confused with *O. speciosum*, which also has smooth capsules, but they are longer and cylindric, not ovoid, and are more exserted; the teeth are in pairs, not single, and the cilia are 8, not 16, and much narrower and tapering. An autograph specimen from T. P. James, collected at Errol Dam, N. H., is also *O. speciosum*, labelled *O. leiocarpum*, and he and Austin seem to have confused all their correspondents, for there are specimens wrongly so labelled, from Macoun, collected at five Canadian localities, from Fowler in New Brunswick, and others, all of which prove to be *O. speciosum*. Macoun's Canadian Mosses, No. 126, distributed as *O. leiocarpum* is, in our set all *O. speciosum*, as the catalogue cites it. Sullivant had the two species correctly separated, as autograph specimens sent to Dr. Torrey show, and in later years Austin corrected his mistake.

ORTHOTRICHUM AFFINE, Schrad. Spic. fl. Germ. 67 (1794).

This species is very differently treated by the three European serials,* now in course of publication, and seems to be very variable, judging by the number of varieties described and the difference in the aspect of the specimens.

It has a strongly ridged exserted capsule, with a short immersed seta, long, tapering neck, and the teeth reflexed when dry, united in pairs, (4) with eight erect cilia. But it varies from yellow to almost black, and in size from 1–5 cm.; also the capsule is either immersed or almost entirely exserted, cylindric or urceolate with a flaring mouth, and the teeth are more or less trabeculate at apex. Venturi keeps it separate from *O fas-*

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*Venturi, Musc. Gall. Part VI. (1887). Braithwaite, British Mosses, Part XII. (1889). Limpricht, Laubmoose, Part XV. (1891).

tigiatum, Bruch; so does Limpricht, but on different characters, Venturi basing the distinction on the papillæ and upper cells of the leaves, whereas Limpricht distinguishes them by the teeth being striolate in *O. fastigiatum*, and papillose in *O. affine*. Braithwaite maintains *fastigiatum* as a variety distinguished by the smaller size and dark green color of the plants, and the urceolate capsule. It will be noted, also, that although Venturi places *affine* among the species with superficial stomata in his key, he figures it with the cells around them overlapping the guard cells. Braithwaite figures them radiating.

The stomata are described by Limpricht as being in two rows around the middle of the capsule in *O. affine*, whereas in *O. fastigiatum* they are said to be few around the base of the sporesac. The typical form of *O. affine* is described by Venturi as having an exserted oval cylindric capsule, the plants being yellowish green and laxly pulvinate, though in the general description he says they may be yellow or dark green with capsules emergent or rarely almost immersed. Limpricht states that the cells of the leaf are thickened throughout in *O. affine*, though not in *O. fastigiatum*, and Venturi claims that the apical cells of *O. fastigiatum* are hexagonal and rounded in *O. affine*. This would agree with Limpricht's observations on the thickening of the walls.

ORTHOTRICHUM FASTIGIATUM, Bruch; Brid. Bryol. Univ. i. 795, 1826.

Sullivant and Lesquereux distributed as *O. affine*, in No. 182 of the 2d Ed. of Musci Bor. Am. two markedly different specimens, collected by Agassiz around Lake Superior, one tall and yellow with long cylindric exserted capsules, the other small and black with immersed urceolate capsules; the latter have striolate and trabeculate teeth, the former has the teeth entire, not trabeculate, and faintly striolate. Evidently then we have the same problem here as they have in Europe, only our material is so scant that we cannot satisfactorily determine whether the two species intergrade or not. Agassiz and Macoun only, have collected around Lake Superior the specimens which agree with *O. fastigiatum*, and all other American specimens which I have seen seem to be *O. affine*. However, a comparison with descriptions of European specimens show that the main characters are constant.

ORTHOTRICHUM SORDIDUM, S. & L. in Austin's Musci App. 168 (1870).

Sullivant, Icones Supplement, 67, t. 49 (1874).

This species comes very close to *O. fastigiatum*, as described by Limpricht, agreeing with it in the trabeculate and striolate teeth. The form given by Sullivant (l. c. fig. 10) is seen occasionally, but the teeth are as often trabeculate at apex, as figured by Limpricht, even in James' own specimens from Cambridge, Mass., which are the ones referred to by Sullivant in the Icones. My experience is, that in the older capsules the delicate trabeculate apex of the teeth is broken off, and they appear as figured in the Icones, though I have seen on one capsule teeth of both kinds. Limpricht makes a point in the position of the stomata to distinguish *O. fastigiatum*, stating that they are few around the base of the spore-sac, whereas in *O. affine* he says they occur in two rows around the middle of the theca. I find in *O. sordidum* that they are usually median as in *O. affine*, but I have seen them both in one row and two. The cilia in *O. sordidum* seem always regular, not appendiculate. The capsule is more immersed and more regularly ovoid when mature, before it becomes sulcate, and the neck is shorter and more suddenly contracted, and almost always immersed and invisible in *O. sordidum*, while in American specimens of *O. fastigiatum*, collected at Lake Superior, by Macoun, the neck is almost entirely exserted. I do not understand why Venturi refers *O. sordidum* to the section of *O. arcticum*, as its alliance seems to me to be entirely with the species with which I have compared it, and its range is from Closter, N. J., almost at sea level to Kent county, New Brunswick, though it has been collected at Dixville Notch, N. H., by T. P. James; the original station being at Cambridge, Mass. The leaves also have the nodose, or porose lower cells, which are specially described by Limpricht in *O. affine* and *O. fastigiatum*. *O. sordidum*, though, seems to be more allied to *O. affine* in its leaves, for the lower cells have thickened walls, the ends in some cases projecting into papillæ, bringing two adjacent ends together so that the papillæ appear double; this gives this species a very characteristic appearance, which I have not observed in either of the others, as the base of the leaves is usually smooth and free from papillæ, though I think the amount of thickening of the basal cells depends on their position, the upper ones from the same plants being quite hyaline and smooth at base, with thin walls. Even the shape of the cells is variable, for they may be oblong and parallel with the vein, or they may be rhomboidal and oblique.

In reply to a recent letter of mine, Dr. Venturi says, concerning *O. sordidum*, that " the group of *O. affine* differs from that of *O. arcticum* only in the position and form of the papillæ on the surface of the teeth. These, like *O. affine*, have the papillæ more dispersed and irregular and occasionally truncate and reduced to intersecting lines, whereas in the group of *O. arcticum* the papillæ are smaller, more dense, and distinctly elevated. *O. sordidum* has the papillæ corresponding to the group of *O. arcticum*, not only in your specimen, but in all the others which I have examined. That would not prevent it, however, from being otherwise closely allied to *O. affine*."

ORTHOTRICHIUM LYELLII, Hook. & Tayl. Musc. Brit. i. 29 t. 22 (1818).

O. papillosum, Hpe. Linnæa, xiv. 458 (1860).

O. Pacificum, Hpe. ms. in Herb. Brit. Museum.

O. Sullivantii, Bauer; Austin in Bull. Torr. Bot. Club, vi. 343 (1879) (?).

O. Pringlei, Müller, Bull. Torr. Bot. Club, xiii. 121 (1886).

O. strictum, Vent. (sub-species nova) Bot. Cent. xliv. 419 (1890).

Such is the published synomymy of this species. Several times it has excited my curiosity, and the following notes and comparisons have been made. Two authentic specimens of *O. Lyellii* collected by Greville in Scotland, in Dr. Torrey's Herbarium are dark green plants with the leaves erect or secund, not crisped, though occasionally recurved or subsquarrose. They are plentifully sprinkled with brown propagula, and are distinctly papillose on both surfaces, or, as Braithwaite describes it, " with prominent conical papillæ." He says in a foot-note that Dr. Spruce found a marked form by the Ouse, near York, in 1843, with rigid closely appressed leaves.

O. papillosum, Hpe. l. c. (*O. Lyellii*, var. S. & L. Musci Bor. Am. Ed. ii. no. 185 (1865).)

O. Lyellii var. *papillosum*, Hpe.; L. & J. Man. 178 (1884).

" Leaves more highly papillose."

As the description given by the Manuel seems very meagre. Hampe's original is quoted:—Laxe cespitosum, adscendens, fusco-viride. Caulis curvatis, ramulosus, inferne nudus, superne planiuscula, foliis oblonga-lanceolata, cellulis alaribus subquadrato-angulatis, hyalinis, superne dense seriatis, elliptico-rotundis, inconspicuis, pagina folii papillis prominentibus scabra, nervo carinato, apice desinente. Theca sessilis, elliptica, leviter striata; peristomia simplici. In Mont. Sierra Nevada, Californiæ. ad saxa? (Bauer). Adnot. Specimini manca, tame species memorabilis foliis secundis. O. Texana, Sull. affine? We have seen the type of this species at the British Museum, and compared it with the specimens distributed by Sullivant & Lesquereux as no. 185 (l. c). The type and a portion of no. 185 agree in the dark green color of the plants, the erect, appressed, strongly papillose leaves, without any propagula. The greater portion of no. 185, however, in our set has the leaves squarrose, the stems more flexuose and the capsules more conspicuously exserted, approaching *O. Pringlei*, though the color is darker.

O. Pacificum, Hpe.; ms. was collected in 1862 by Bauer on granite rocks near San Francisco on the shore of the ocean. The plants are dark green, 6 cm. long, rigid, with appressed leaves and little fruit. The calyptras are immersed and hairy, the old capsules exserted on short pedicels and the lids are gone. It does not differ from *O. papillosum* sufficiently to be a species.

In Sullivant's herbarium I found the following note:

"*O. Lyellii* shows a most wonderful disposition to vary according to place of growth. The Californian and Oregon specimens differ only from the European in having longer, narrower leaves, more crisped and undulate on the margins when dry, and scarcely ever having on their surface the articulated glands (conferva orthotrichi). In nothing else is any difference perceptible." (Examined several times carefully.—W. S. S., Oct., 1856).

In the original description of *O. Lyellii* (Musc. Brit., p. 130), the leaves are described as follows: " On various parts of their surface the conferva orthotrichi grows in abundance, so that they appear strewn with a brown powdery substance."

I also have examined all the American specimens in our herbarium and many European; and the latter always differ from the former in the abundance of the propagula, as well as in being less crisped. All the American specimens at Kew are without propagula.

O. Sullivantii, Bauer, is referred to by Austin in the BULLETIN (l. c.) as "growing on trees, having the peristome reflexed when dry and the leaves of a different texture from *O. Hainesiæ*," but I can find no reference to it elsewhere. I have seen the specimens collected by Bauer, and they also have no filaments, and are probably *O. papillosum*, Hpe.

Orthotrichum Pringlei, C. Müller (l. c.)

Pringle's types were collected at Winchester Bay and Coos River, Oregon, and are remarkable for the light yellowish green color and flexuose branches, as well as for the curly leaves. Fine specimens have also been sent to us by Thomas Howell, from Yaquima Bay, in mats six inches across, unmixed with any other species. At first sight, it would not be referred to *O. Lyellii*, and without seeing the specimens growing and intergrading I should incline to maintain this as a species. In a letter from C. Müller, to whom I sent a series of specimens, he says, July 13, 1888, "Ich melde Ihnen, dass ich jetz damit einverstanden bin, mein *Orthotrichum Pringlei* ad forma longifolia crispata papillosa *O. Lyellii* zu bringen. Hampe nannte es einmal *O. papillosum*, ein anderer mal *O. Pacificum*."

I have seen all the types of Hampe's species referred to, and he never had any specimens corresponding to *O. Pringlei*. All his were dark green and rigid. The only other localities from which *O. Pringlei* is represented in our herbarium are Vancouver Island, collected by Macoun, May 17, 1875 (203), and a few scraps collected by W. H. Shockley, at Candalaria, Nevada, and part of S. & L. Musci Bor. Am. number 185, which also has flexuose branches, though the color is darker green, collected by Bolander in California. All the other specimens collected in California by Bolander, Watson and M. A. Howe are dark and rigid. J. B. Leiberg's specimens from near Lake Pend d'Oreille, Idaho, are bright green and stiff, and this is the easternmost locality represented in our herbarium.

Orthotrichum strictum, Vent., is described as a "subspecies of *O. Lyellii*, without propagula, and the leaves lanceolate and straight, the capsules short stalked, otherwise as in *O. Lyellii*."

I have not seen Roll's specimens, but from the description I see no differences sufficient for making a new sub-species when we have already several synonyms abundantly defined. I am not a believer in sub-species either, and question whether this is not *O. papillosum*, Hpe.

Renauld and Cardot, in their check-list of North American mosses, maintain four species, Nos. 543–546. Probably only two of these will stand, *O. papillosum* and *O. Pringlei.*

A large suite of European specimens of *O. Lyellii* from the Jaeger Herbarium shows none approaching *O. Pringlei* in the general aspect of its curly leaves and flexuose branches.

ORTHOTRICHUM DOUGLASII, Duby. Mem. Soc. Phys. d'Hist. Nat. de Geneve, xix. 293, t. I. fig. 2 (1868).

Through the kindness of M. Barbey and M. Eugene Autran, of the Boissier Herbarium, I have seen the type of this species in Duby's herbarium, collected by Douglas on the Columbia River, in 1830. In comparing the specimens with the description, l. c., I find one discrepancy. The description reads as follows: "theca erecta cylindrica sub ore parum dilatata fuscescente ecostata basi subplicata." The capsules are not *ecostate*, for the walls show eight yellow bands of three or four rows of thickened cells, forming short ridges when the capsules are old and dry. The stomata are small and superficial, usually one at the termination of each band, in the middle of the theca, not around the base of the sporesac; the surrounding cells are not much modified nor radiating. The following measurements may be of service in identifying the species, which has not been collected since it was described: Seta 2 mm. long, vaginule 1 mm. long, theca 2.5 mm. long and 1.33 mm. broad, the neck defluent into the seta, exserted beyond the perichætial leaves, which are 2–3 mm. long, 1 mm. broad, with a blunt apex, hyaline concave base, without a revolute margin. They almost entirely cover the seta. There are but a few capsules preserved; one is quite immature, with the calyptra still on, and the others are old and deoperculate, but Duby kept in a mica slide, mounted in balsam, the peristome from which the figures were drawn. Figure b. represents the teeth shorter, and with fewer segments than the original; they are erect when dry. The mouth is bordered by several rows of smaller cells, and there is a hyaline annulus. Figure d. also is poor, because the type has the neck defluent, and figure f. because the calyptra is lobed, distinctly striate, and is not nearly as wide as represented, its base clinging close to the base of the capsule, which, however, is immature. I compared the specimens with *O. Texanum*, number 187 of S. & L. Musci Bor. Am., ed. II., 1865, and with the plate of the latter in the Icones. The leaves are very similar, being carinate, with strongly revolute margins, the apex acute, and often plane for a short distance above the point where the vein disappears, or the vein may be percurrent. The base of the leaf in *O. Texanum* is narrower and more decurrent at the angles, and the margins are revolute to the base; the vein is broad and thick, often brown, and the basal cells are yellow, oblong or sinuous.

It seems probable that *O. Douglasii* must be masquerading under another name in our herbaria, but owing to the imperfect condition of the type, it would be difficult to prove this.

ORTHOTRICHUM KINGIANUM, Lesq. Mem. Cal. Acad. i. 18 (1868), Sull. Icon. Musc. Suppl. 74, t. 55 (1874).

When studying the mosses collected by J. B. Leiberg, I was permitted by Dr. Watson to examine the type of this species, which has only been collected once, by Bolander at the Falls of the Yosemite. It is closely allied to *O. lævigatum*, Zett., and the similarity will be apparent if the figures of both are compared. *O. lævigatum* is described as a variable species by Venturi, and is much more common in America than the Manual would indicate, as it cites only one locality in Western Nevada (Watson). Our specimens from this locality, No. 1404 Watson, are not this species but seem to be *O. Watsoni.* Macoun collected *O. lævigatum* at the Cascades at Yale in 1875, and Austin described it as *O. Macounii*, n. sp. (BULLETIN, vi. 343, 1879), but subsequently referred it to *O. Kingianum.* It has recently been distributed in Macoun's Canadian mosses as No. 454, and has been collected in two localities near Lake Pend d'Oreille by Leiberg, showing mixed with it forms with a broader pyriform capsule and shorter seta, as in *O. Kingianum.* More study and material is desirable of these four species.

B. Those with immersed stomata.

ORTHOTRICHUM ANOMALUM, Hedw. Musc. Frond. II. 192, t. 37 (1788).

I have not seen the type of this species, but it would be desirable to know whether it has the teeth united in pairs, and whether the cilia are present, as Limpricht maintains *O. saxatile*, Brid., on these characters. Braithwaite recognizes it only as *O. anomalum*, var. *cylindricum*, Sch., claiming that though Bridel's name is the older it should be rejected because it was used to include both *O. anomalum* and *O. saxatile*, forgetting that according to the Paris code the enlargement or restriction of a species does not warrant a change of name. Venturi also considers it only a variety of *O. anomalum*, but calls it var. *saxatile*.

We have found that No. 177 S. & L. Musci bor. Am., Ed. II., distributed as *O. anomalum*, agrees with the description of *O. saxatile* given by Limpricht, in having the teeth united in pairs, and eight cilia alternating with them; also the ridges of the capsule are only 8, with occasionally only a trace of the intermediate ones; the capsules are much exserted, cylindric, and longer than in *O. anomalum*. The leaves also have the walls of the lower cells thickened nodosely, and the perichætial leaves are 4 mm. long. The specimens were collected at Niagara Falls, and we have not seen this species from any other locality, though it may be looked for among those labelled *O. anomalum*, and has probably been mistaken for that species.

ORTHOTRICHUM CUPULATUM, Hoff. Deutsch. fl. ii. 26 (1796).

O. strangulatum, P. Beauv. Prod. 81 (1805), fide Braithwaite.

O. strangulatum, Schwaegr. Suppl. I. ii. 53, t. 34 (1816).

I have not verified the synonymy of this species, though the types are probably at Geneva. *O. strangulatum*, Sull., of the Manual, however, is doubly debarred, as Venturi says it is the same as *O. Braunii*, Br. & Sch. As is well-known, *O. cupulatum* forms a marked group of closely allied forms or species, and hence has been variously treated by different authors. Braithwaite describes it as a polymorphous species with one variety, *nudum* (*O. nudum*, Dicks). Venturi recognizes *O. nudum* as a species, besides separating off *O. urnigerum*, Myrin, *O. Sardagna-*

num, Vent., and *O. Venturii*, DeNot. Limpricht recognizes six species in the Laubmoose, and Austin separated off *O. Porteri*, *O. Peckii* and *O. Lescurii*, the last of which was figured in Sullivant's Supplement to the Icones as var. *minus*, and referred with the other two to *O. cupulatum* as varieties.

Recently, in studying the genus, I came to the conclusion that Austin's view was more in accordance with modern methods, and seeing that Dr. Venturi had not seen specimens of Austin's species, I sent him authenticated specimens asking him for his opinion. In a letter dated the 11th of September, he says:

"I have at present at my disposal a set of Austin's Musci Appalachiani, and I find that the specimens of *O. Lescurii* and *O. Porteri* agree with those you have recently sent me and with the observations made in your letter. I find, however, in the packet containing *O. Porteri* another label belonging to *O. Peckii*, and being unable to distinguish the two forms, which perhaps are mixed in my specimen, I cited them as synonymns in the Muscologia Gallica. Recently, with the aid of your specimens, I have obtained a more positive notion of the characters of *O. Porteri*, which is not found in Europe. I am however still in doubt about *O. Peckii*, of which I have a morsel sent me by Lindberg from his set of the Musci Appalachiani. It may be that *O. Peckii* is simply a variety of *O. cupulatum*, but *O. Porteri* is in my opinion much more than a variety. The idea of a species is and always will be subjective and changeable according to the views of different authors. Now-a-days, when species are shaken and pulverized, as for example, *O. pallens* in Limpricht's Laubmoose, and *O. nudum* and *O. Sardagnanum* rank with *O. cupulatum*, we cannot without contradiction refuse to recognize *O. Porteri*. It is true that it has a distinct preperistome, but without the diagonal striations; and the teeth besides the longitudinal lines have their outer surface papillose. Of more importance and more conclusive in my opinion, is the elongated form of the capsule, which is occasionally almost cylindric, and the color of the ridges of the pericarp being an orange red instead of yellow. In several particulars *O. Porteri* is intermediate between *O. cupulatum* and *O. anomalum*, having the short truncate base of the capsule as in the former and the ovate-cylindric form and color of the capsule of the latter. Besides the hairs of the calyptra in *O. Porteri* are distinctly papillose and composed of 3–4 series of cells, whereas those of *O. anomalum*, if they exist at all, are almost simple. With *O. nudum* and *O. Sardagnanum*, it has no resemblance, as their distinctive character is the defluent neck of the capsule. I shall, therefore, uphold the autonomy of *O. Porteri*, leaving solely *O. Peckii* as a variety of *O. cupulatum*, as I have modified my opinion since I wrote the monograph for M. Husnot.

As for *O. Lescurii*, that also is in my opinion, an excellent species, even though the very small capsules have the form of the capsule of *O. cupulatum ;* for the ridges are always eight in *O. Lescurii*, and the peristome is papillose and without a preperistome, besides all the other characters which determine a species."

I do not agree with Dr. Venturi in referring *O. Peckii* as a variety to *O. cupulatum*, for it has only eight ridges to the capsule, which is also elongated as in *O. Porteri*, and it is to the latter species which it should be referred as a synonym, to which position Austin consigned it in his herbarium and in the BULLETIN (vi. 341, 1879).

ORTHOTRICHUM BRACHYTRICHUM, Schimper.

O. brachytrichum, Sch.; L. & J. Proc. Am. Acad. xiv. 140 (1879).

Drummonds Musci Americani, 157 pp. with *O. obtusifolium.*

Austin, Bull. Torr. Bot. Club, vii. 8 (1880). Macoun's Cat. 90 (1892).

We have been favored with a portion of the type of this species from Kew, and have also seen four sets of Drummond's mosses Dr. Torrey's, Sullivant's and those belonging to the Academy of Natural Sciences of Philadelphia, and the Geological Survey of Canada at Ottawa. In all except Sullivant's the specimens are all *O. obtusifolium*, but in his set they are mixed with *O. brachytrichum.* The type of the latter, though much resembling the former in its erect-appresssed leaves, bearing septate propagula, has the leaves acuminate, not obtuse, at apex, often erose or denticulate, occasionally cuspidate and hyaline like *O. diaphanum;* the margins are revolute and the cells faintly protuberant, not papillose; the stomata are immersed, not superficial, and the calyptra sparsely hairy. It differs from *O. diaphanum* in having only eight cilia, and the teeth are united in pairs (4-parted), not single.

In Austin's herbarium there is an autograph specimen from James, which is probably the one referred to in the BULLETIN (l. c.), labelled *O. obtusifolium*, Drummond's No. 157, on which Austin has written: "equals *O. brachytrichum*, Sch., of course it is *O. obtusifolium*," as undoubtedly it is, James having sent him only a part of Drummond's 157, and not the same as that he sent Schimper. The specimen of *O. obtusifolium* collected by Austin in Jordansville Swamp, New York, 1868, above referred to, has both acute and obtuse leaves on the same plants. These helped him, also, to confuse the two species.

Unequal Segmentation and Its Significance in the Primary Division of the Embryo of Ferns.

BY GEO. F. ATKINSON.

In studying the embryos of several species of the Polypodiaceæ, sections were obtained of the primary division which suggested the possibility of some fundamental law governing unequal segmentation of the egg, in some species at least. In finishing a camera lucida sketch of an embryo of *Pteris serrulata* I noted what at first was not observed, the two cells with their nuclei were of unequal size. Thinking some error might have arisen in connection with the first sketch the preparation was examined again, when it was easy to note the smaller size of the nucleus in the smaller anterior segment. . Measurements with the micrometer showed that the diameter of the nucleus in the posterior segment was one-fourth to one-fifth greater than that of the anterior segment.

If this state of things were reasonably constant it would show a definite relation existing between the primary segmentation and the different functions of the two segments. That is to say, the nucleus of the egg first divides into two unequal nuclei, an anterior one smaller than a posterior one; that these unequal nuclei govern the size of the two primary segments of the embryo by which that part of the plant chiefly concerned in supplying nutriment, the root segment, is differentiated from that part chiefly